MAGLEV EVALUATION

American Maglev Technologies, Inc. (AMT)

December 2011

OVERVIEW

In light of the recent attention brought to Cobb County because of the Federal Transit Authority funding of the Alternatives Analysis (AA) for Transit in the Northwest Corridor, Cobb DOT has been approached by different vendors who have been focused on informing us of potential alternative transit vehicle systems that could be utilized if a light rail alternative is the eventual outcome of the AA. Some of these vendors include:

- American Maglev Technologies, Inc.
- Owen Highroad Rapid Transit System
- Tubular Rail, Inc. Rapid Transit System

More of these vendors will become involved as we move towards a conclusion in the AA process. To address these vendors interest and feasibility, Cobb DOT formed a committee that has evaluated these technologies. This committee has met with each of the three vendors above and after having additional questions and concerns answered, has produced white papers on these technologies highlighting what DOT considers to be the benefits and challenges for each of these applications. Other vendors will approach CCDOT as a mode selection is made as part of the AA and they will be evaluated in a similar manner.

One of these vendors, American Maglev Technologies, Inc. (AMT) has received some recent support in the community and has presented at a recent Town Hall Meeting in the County. The purpose of this document is to provide a fair, objective look at this technology and present the questions and concerns that must be answered and resolved prior to potential implementation of this technology.

Some of the background material, history and technology referenced in this document were assembled from AMT's comprehensive website, which can be referenced http://american-maglev.com.

AMT HISTORY

AMT began as a Corporation in 1994 as American Maglev of Florida, Inc. AMT's president is Tony Morris. AMT developed a test track in Edgewater Florida in 2001 with assistance of the local government. At this test track AMT was able to develop and test its maglev theories for levitation and propulsion.

There have been issues with AMT regarding a failed venture at Old Dominion University in Virginia. Available on the internet are a number of news articles regarding AMT's past performance. In particular is a concern that the Old Dominion University project was unsucessful after the vehicle did not properly operate as funding was exhausted and contractors were not paid. The depth of our research into this issue was only what was available on the internet and may not provide an objective view of what occurred, but it cause for concern. AMT provides an explanation on their website of what occurred at Old Dominion University. This information is attached below:

> *After years of successful levitation and propulsion testing in the rural Florida swamp, AMT was awarded its first project on the campus of Old Dominion University (ODU) in Norfolk, Virginia in December 2000.*
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> *Despite bringing more than $9 million to the project in private funding—not to mention a significant portion of the Edgewater test track—inevitable delays caused by transit and federal funding agencies delayed groundbreaking until 2001. In July 2001, AMT finally broke ground on the ODU project. Simultaneously, engineers in Edgewater were continuing to test the technology to ensure a smooth transition at ODU. (RIGHT: Vehicle testing in Edgewater)*
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> > *Thirty-seven days after groundbreaking, the civil works portion of the project was complete. The incredible momentum of the campus peoplemover research project prompted a momentous groundbreaking ceremony, capped by a rousing speech by Virginia's then-Lt. Gov. John Hagar:*
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> > *"…I thank you for daring to go beyond the conventional image of what a "University" is supposed to do. And I thank you for ignoring the skeptics and recognizing that the price of progress is risk. You may not realize it today, but this may well be the best lesson you can pass on to Virginia's leaders of tomorrow – as was the case with the pioneers of 400 years ago, the timid need not apply."*
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> *Lt. Hagar spoke these words two weeks before 9/11. Needless to say, such circumstances delayed much of the federal funding in lieu of new security, defense and wartime initiatives. Despite securing a minimal amount of additional private investment, much of the project was placed on hold until budgetary demands were fulfilled.*

The Federal Government finally released the funds to ODU in 2004. However, the government only provided $2 million of the $7 million it had promised at the onset of the project. Of the $2 million, $1.5 million was distributed to ODU for research purposes and $500,000 was distributed to AMT. All of AMT's funds were used to pay off prior commitments to patiently waiting contractors and vendors.

AMT continued to work on the project for free, despite many budgetary struggles and a few technological oversights. One such oversight was the reaction between the vehicle and the elevated guideway. All levitation and propulsion testing at the Edgewater test facility had been completed on solid ground. AMT was assured by its engineers and team of strategic partners that there would not be any problem in transitioning the vehicle from solid ground onto an elevated guideway. There was in fact a problem. The vehicle was not as flexible as the engineers first thought; the stiff vehicle combined with the flexible beams of the elevated guideway created problems with levitation. As it turns out, there was a very simple solution to this problem. The vehicle needed to have a proper suspension system in order to make it more flexible. This solution, however, became apparent after the project was put to rest due to lack of funding.

In late 2005, ODU informed AMT that the project was much better suited as a part of the campus research program, and that AMT's role in the project had been fulfilled. AMT continues its relationship with ODU and maintains contact regarding research and continued interest in maglev.

Since relocating from Florida, AMT constructed a half mile test track in Powder Springs, Georgia in 2006. The test track was fully operational in 2007 and has been used for development and research as well as providing tours to showcase the vehicle and the technology.

MAGLEV PRINCIPLES

[From Wikipedia.org] Maglev, (derived from magnetic levitation), is a system of transportation that uses magnetic levitation to suspend, guide and propel vehicles from magnets rather than using mechanical methods, such as wheels, axles and bearings. Maglev transport is a means of flying a vehicle or object along a guideway by using magnets to create both lift and thrust, only a few inches above the guideway surface. High-speed Maglev vehicles are lifted off their guideway and thus are claimed to move more smoothly and quietly and require less maintenance than wheeled mass transit systems – regardless of speed. It is claimed that non-reliance on friction also means that acceleration and deceleration can far surpass that of existing forms of transport. The power needed for levitation is not a particularly large percentage of the overall energy consumption; most of the power used is needed to overcome air resistance (drag), as with any other high-speed form of transport.

AMT TECHNOLOGY

In particular, the maglev technology used by AMT has reversed the standard design concept in which the guideways generate the magnetic forces necessary to levitate and propel the vehicle. In the AMT concept, the track is "dumb" and all of the magnets and controls are components built as part of the transit vehicles. AMT's particular claims to the advantages of this technology include:

- Low cost for installation and implementation. AMT technology allows for the construction of transit systems that would not exceed $13-$19M per mile. This would allow the system to be economically sustainable with a reasonable ridership expectation.
- 70% net less energy than conventional transportation energy usage. This is an outcome of the low-weight vehicle and the implementation of the maglev technology built into the cars.
- A zero carbon footprint
- Low cost and maintenance. Only moving parts are in the ventilation system and in the doors for the vehicle. There are no other moving parts in the system.

AMT's other claims regarding the benefits of using its technology over others include:

- AMT combines the efforts of 118 US Companies representing 26 US states and 77 congressional districts. They are committed to the "Buy American" philosophy and in the jobs creation that results.
- AMT has entered into a 10-year exclusive global alliance with Grupo ACS from Madrid Spain, giving them the ability to design, build, finance, operate and maintain transit systems.

AMT PROPOSED SYSTEM (from September 2010 Presentation to CCDOT)

The specific route of the proposed AMT system was from Kennesaw State University, south on I-75 to the Cumberland area then down I-285 to Atlanta Road, down Atlanta Road, Marietta Blvd and then east to the Arts Center Station. Proposed stations were at KSU, Cobb Parkway, Big Chicken, Delk Road, Galleria, Cumberland Mall, Atlanta Road at I-285, Atlantic Station and connection to the MARTA Arts Center Station.

Cobb County Connector (C3) – System Summary	
Capital Cost	$441 Million
Construction Period	24 Months
Passenger Stations	10
Days of Operation	365
Hours of Operation	20
Number of Vehicles	12
Maximum Capacity/Train	220
Headways	5 minutes

One-Way Trip time	30 minutes
Peak Hourly Capacity	2,640 passengers
Daily Capacity	26,400 passengers
Annual O&M	$9.38 Million

AMT Proposes an environmentally sustainable system by installing solar panels along the tracks and atop stations to generate 1 MW of solar energy per 5 miles of track. Each AMT Vehicle requires 100 kW per hour for full operations. On sunny days, AMT will be able to fully operate exclusively on solar power.

AMT says that this will create 75 permanent jobs and create 600 construction jobs at the peak In the first year of operation, AMT predicts saving 151,200,000 vehicle miles travelled, saving 7,448,276 gallons of gasoline and avoiding 66,357 metric tons of CO_2 emissions.

AMT says this system can be a financially sustainable system with a guaranteed ridership of 21,000 daily passengers that would be guaranteed by the County. In exchange, AMT would finance the design, construction, operation and maintenance on the system. Cobb County would also have revenue sharing rights for ridership over the required 21,000 passengers per day at $4 fares per one-way trip.

Schedule for implementation for the proposed system is:

- Obtain Approvals,Permits & Funding – January 2010 through December 2011.
- Construction – Spring 2011 through December 2012.
- System Operational – January 2013.

AMT predicts the system to cost $440.6 million, with the initial outlay being 80% financed. Minimum ridership guaranteed fluctuates with the interest rate that AMT would have in their financing package. The 21,000 passenger per day minimum requirement is based on them being able to attain a 3% interest rate. This climbs to about 24,000 riders at a 5% interest and about 33,000 for an 8% interest rate.

Annual operating cost for the system is estimated at $9.38 million, with half of that fee going to labor costs.

Much of this information is summarized by a PowerPoint presentation given by Mr. Morris. Additional questions were asked after the Cobb DOT evaluation committee met. Additional information supplied by Mr. Morris includes:

- AMT's model includes a 13.5% contingency; $49.4 million.
- Park and Ride Lot at or near the stations are not included in this figure.
- Security Personnel are included.
- Right-of-Way is not included in the costs. AMT has made the assumption that GDOT and Cobb will donate anything in current ROW and that when the line departs from I-75 for a station that the adjacent landowner, who will benefit from the station site, will be expected to donate the necessary right-of-way.
- Reimbursable utility relocation costs (off county/state ROW) are partially covered, but probably not enough funding to cover that expense.
- AMT's system is compliant with FTA's "Automated People Mover Standards", but has yet to develop a System Certification Program Plan (SCPP) and a System Safety Program Plan (SSPP).
- An emergency walkway between the tracks is proposed for the entire length of the system to accommodate emergency evacuations.
- Stations would be fully ADA compliant and stations designs could be flexible to make the system "uniquely Cobb", but would need to stay within budget constraints. There will be extensive use of electronic surveillance provided at stations.

AMT PROPOSED SYSTEM (from November 10, 2011 Presentation – Commissioner Ott THM)

This section discusses some of the details provided from the November 10, 2011 presentation by Tony Morris at Commissioner Ott's Town Hall Meeting in the East Cobb Library.

The proposed route has changed and now AMT is suggesting a 22 mile line from Kennesaw State University, down I-75 south, to I-285 east over to the Perimeter Mall area, making a connection at MARTA's Dunwoody Station. There are 9 stations suggested throughout the system.

Specific details of this alternative provided by Tony Morris:

- To fund the entire venture, requires 34,000 riders per day guarantee at $4 per one-way trip.
- 20 hours/day operations.
- 5 minute headways between vehicles.
- 110 passengers per shuttle
- Speeds up to 60-65 miles per hour.
- Passes through 11 jurisdictions that could share in the guarantee of the needed 34,000 riders per day necessary to have the entire venture 100% funded.

- Assumes that all right-of-way would be donated for the project by Cobb County/other local jurisdictions, and GDOT on the interstate.
- AMT could construct 1 mile a week of foundations and track down the center of the interstate.
- Caissons in the interstate would be 5.5 feet in diameter and be sunk 30' into the ground. One caisson could be installed in a 30 minute time frame including drilling and installation.
- Environmental approval of this alternative could be done with a Categorical Exclusion (CE) to quickly implement the project.
- The system could be constructed and operational by 2015 if decisions were made quickly. This would far exceed the delivery time that would be necessary to roll out a light-rail system from the current process, currently in the Alternatives Analysis process.
- No park and ride lots would be funded by AMT as part of this financial plan. Private development would be spurred by the AMT line and this private enterprise would be responsible for funding the park and ride lots.
- Only minor security would be provided as part of the plan. Additional police precincts might need to be added by the local governments along the line to accommodate security needs.
- AMT's system could be able to maintain constant speeds up to a 10% grade to handle some of the challenging terrain along the system.

AMT FUNDING AND OVERSIGHT

Although the funding model proposed by AMT includes no Federal funding, they certainly would be required to comply with systems and safety regulations by either the Federal Transit Administration (FTA) or the Federal Rail Administration (FRA). These regulations are complex and stringent because of potential catastrophic loss of life that could occur if an accident were to occur.

Although it seems that the FTA would oversee this type of a development, there have been several recent actions in which FRA stepped in with authority over these kinds of systems. FRA regulations controlling these systems are much more stringent than the requirements of the FTA. FRA oversight of the system would result in significant additional costs for safety and system testing and approval as well as implementation cost.

There was a recent Federal county case involving the issue of FTA and FRA oversight. Findings from the United States Court of Appeals (4th Circuit), in which the Research Triangle Regional Public Transit Authority sued the FRA in a claim that they had no oversight of their project. In the document, FRA was found to have authority and oversight over the Triangle Transit Authority (TTA) for the following reasons:

- The FRA has oversight of the TTA project because the Federal Railroad Safety Act defines "railroad" to include "commuter or other short-haul railroad passenger services[s]" and "high speed ground transportation systems that connect metropolitan areas."
- FRA deemed the TTA project to be a commuter operation (and subject to FRA jurisdiction) because [1} The system serves and urban area, its suburbs, and more distantly outlying communicates in the greater metropolitan area, [2] The system's primary function is moving passengers back and forth between their places of employment in the city and their homes within the greater metropolitan area, and moving passengers from station to station within the immediate urban area is, at most, an incidental function and [3} The vast bulk of the system's trains are operated in the morning and evening peak periods with few trains other times.
- By contrast, FRA will likely deem an operation to be rapid transit (and no FRA oversight), if [1] The operation serves an urban area (and may also serve its suburbs), [2] Moving passengers from station to station within the urban boundaries is a major function of the system and there are multiple station stops within the city for that purpose (such an operation could still have the transportation of commuters as one of its major functions without being considered a commuter railroad), and [3] The system provides frequent train service even outside the morning and evening periods.

Much more detailed information regarding this particular court ruling can be found on the internet. A determination of the oversight of the FRA over this kind of operation is not clear at this time, but it certainly is something that could significantly impact the delivery time, cost, and risk to the project.

CURRENT CONCERNS

At the December 14, 2011 Cumberland Improvement District Retreat, this issue was discussed and presented by Commissioner Ott. Commissioner Ott stated that AMT is in the process of putting together a formal offer to be considered by the County and the adjacent impacted jurisdictions for the KSU to Perimeter Mall route.

If there is consideration to this proposal, Cobb DOT and other jurisdictions will require detailed answers on a number of concerns that have been raised through this process. It is likely that many of these concerns are known and have been addressed by AMT, but before any consideration is put forth into moving forward with discussion on this project, they need to be fully addressed so that it is clear what would be provided and what additional costs might have to borne by local government.

<u>Technology Concerns</u>

AMT states that with the testing and implementation at its Powder Springs location that this is a technology ready to roll and that it could be open and operational in 2015. But this is a closed, carefully controlled test facility, not fully operational and tested.

While the potential savings from AMT in energy, maintenance on vehicles and guideways is something very worth pursuing, there is a lot more development needed for this technology prior to Federal approval and rolling out on a large scale as proposed. We believe AMT is a long way from approved commercial application and that the costs are seriously understated, although they do eventually have the potential to be less than standard light rail. In summary, even if the systems issues could be identified and quickly resolved, service would more likely start as far as 10-15 years from now as opposed to the two or three years from now using existing technologies.

There are some real concerns on whether the safety and systems tests could be accomplished and accepted by FTA or FRA given the restrictions and limitations to the short length, lack of gradient and curvature on the test track. There are many components that we have concerns about:

- Concerned that to meet some of the ridership requirements during peak periods that the vehicle will have to operate in a "crush loading" condition. This is the same weight loading requirements in other transit systems requiring significant increases in vehicle weights and safety features. How does AMT provide these features with the ultra-light vehicles they are proposing?
- How could this mostly unproven technology be rolled out for the large proposed system without smaller trials involving multiple vehicles, different terrains, severe weather conditions, track switching, curvature and loading characteristics similar to actual operations? It will take some significant work and time to achieve the FTA requirements for a System Certification Program Plan (SCPP) and a System Safety Program Plan (SSPP).
- There are concerns regarding claims that the AMT system could operate up to 10% grades without impact to vehicle performance or speeds. Standard light rail tries to maintain most sections of rail below a 5% gradient.
- Concerns that light weight of the vehicle and equipment will limit safety, dependability, longevity and maintenance costs.

<u>Business Model Concerns</u>

- Concerns regarding the failed venture at Old Dominion University and the similar risk on a much grander scale that would result if the Cobb proposal was pursued.
- Serious concerns that the proposal to have this facility constructed and operational in 2015 does not account for the approval time from FHWA/GDOT, necessary environmental and public involvement process, right-of-way acquisition, and a realistic construction time. More substantial concerns are that the technology is years away from the performance and certifications required to receive approval from FTA/FRA for systems operations and passenger safety.
- Even without the use of Federal Funds to finance this project, use of the Interstate will require detailed environmental documentation and public involvement. It is likely that a facility of this magnitude will require a full environmental impact study (EIS) which will require years of meetings, studies and approvals.

- There are concerns that if AMT uses the median of the interstate to construct their facility, that they will have to fly over all existing interchanges, which will put their track level about 50 feet (and vehicle top at 60 feet) above the interstate. This will result in severe public resistance because this facility will be visible from many neighborhoods adjacent to the interstate. With the large number of jurisdictions that this facility will pass through, it will be a real challenge to garner the support needed for this project to occur.
- AMT claims that there construction along the interstate would proceed at a rate of about 1 mile per week and that caissons sunk into the interstate median would only take 30 minutes to place. These claims are not even remotely possible given current construction methods and procedures.
- It has been shown by several studies that the most effective and productive route from Cobb County involves a connection to the downtown Atlanta. The proposed Perimeter area connection instead of an Atlanta connection will have a significant impact on the potential ridership numbers. Although a connection at Perimeter would allow a transfer and transit to Atlanta, the extra time delays will discourage many riders from taking this alternative.
- One of the greatest concerns regarding the minimum guaranteed ridership requirement is in regards to transfers from the MARTA system. Current transfer agreements are in place throughout the metro area, but these agreements will significantly reduce the number of fares paid to AMT without requiring payments at each transfer onto the AMT system. For instance, if a rider's transit route was from the Marietta CCT transfer station to a job near Perimeter Mall: He/she would pull full-fare to board the CCT bus, taking him/her to the nearest AMT station. The rider would need to pay an additional fare to enter the AMT system. At the Perimeter AMT station, it is assumed that the existing transfer agreement would hold true and the passenger could board a MARTA bus for no additional fare. On the ride home, the passenger would pay to board the MARTA bus, pay full-fare again to enter the AMT system and receive a transfer at no additional cost to board the CCT bus for the Marietta transfer station. This would result in 4 separate fares for a two-way trip, currently amounting to (2 x $2.50) + (2 x $4) = $13. This amounts to a cost for this commuter of $65 per week, or about $280 per month. This cost will have a significant impact to the ridership.
- Right-of-Way needed for the facility would be provided by CCDOT, other local jurisdictions, GDOT and FHWA within existing right-of-way. Detailed discussions on track, alignment, construction methods, etc., would need to occur before GDOT or FHWA would allow a facility of this kind within the interstate right-of-way. Furthermore, the belief that private properties would donate their right-of-way because of the benefit of the rail access in or near their properties would be difficult to achieve and certainly something that cannot be counted on in the finance model. Other concerns are the legality of condemning private properties for the benefit of a for profit private company.
- Utility relocation costs for this project will be very substantial. There is no designated funding in the model for these relocations. Additional concerns are that if AMT is building this line as a private enterprise that utilities located in local jurisdictions or GDOT ROW will consider this a

relocation due to a private development and will require full relocation costs to be borne by that developer.

- There are no funds in the model for the construction of park and ride lots within the system. Without the park and ride lots, it is very questionable whether we could develop the minimum ridership guaranteed as part of the development. The notion that new developments within the corridor will take on the expense of building park and ride lots is faulty.
- In discussions with AMT, it seems that there facility will provide some skeleton of a security force, but it will be incumbent on all of the adjoining jurisdictions to develop, coordinate and maintain a police presence throughout the system. This will account for significant additional cost to the local governments.

SUMMARY

As of April 2012, no official proposal has been received by AMT. For CCDOT to be able to properly evaluate the use and feasibility of this technology, their proposal should address many of the concerns outlined above and be very clear on what AMT will be providing and what the County/Municipalities bordering their proposed alignment will be responsible for. This should include detailed short and long-term obligations for the project.